Impact of COVID-19 Pandemic on Financial Markets: a Global Perspective

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Received: 28 September 2021 / Accepted: 22 January 2022

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Abstract

This study aims to examine the influence of the COVID-19 outbreak on daily market returns in most affected developed and emerging markets. For this purpose, panel data of 30 most affected developed and emerging markets over the period January 1, 2020, to December 12, 2020, were analyzed by using panel estimated generalized least square (panel-EGLS) and panel quantile regression approaches. The results confirm that the new COVID-19 daily cases and deaths adversely impact daily market returns around the globe. Also, the positive rate of new COVID-19 cases has also negatively influenced market returns. Further, the number of new COVID-19 daily tests conducted has a positive impact on market returns. Interestingly, the study also found similar impacts for both developed and emerging markets except the news announcement of new COVID-19 daily deaths, which have a positive impact on emerging market returns. The findings of this study present some policy implications for governments to adopt early proactive and control measures to protect financial markets from an adverse decline in future pandemics and to increase investors' confidence.

Keywords COVID-19 pandemic · Market returns · Global markets · Panel quantile regression

Introduction

On December 31, 2019, the outbreak of coronavirus (COVID-19) started in China and spreads to 220 countries and territories around the globe. On March 11, 2020, the World Health Organization (WHO) declare it a global pandemic (Kickbusch et al., 2020; Phillpou et al., 2020). Coronavirus is a democratic virus that affects

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humans without their nationality, race, color, and religion, because the COVID-19 pandemic affects everyone, across borders, gender, and race (Cuesta & Pico, 2020). This uncontrolled pandemic has changed the life of the people and forced the governments to shut down schools, universities, offices, businesses, and worship places like mosques, churches, temples, etc. To control further spread, some governments lockdown their major cities and towns by imposing a ban on unnecessary social gathering events like funerals, marriages, sports events, national celebrations, tourist spots, etc. These types of restrictions forced people to “stay at home” (Oliveira et al., 2021). The current pandemic of COVID-19 is unprecedented and developing rapidly (Gormsen & Koijen, 2020), for which targeted therapeutics for treatment are under trials (Boot et al., 2020; Guan et al., 2020).

Given the continued lack of clarity of information pattern about the COVID-19 pandemic (Lloyd, 2020; Najam, 2020), and the unavailability of proper medications (Guan et al., 2020), increases the fear and panic among the people around the globe. This general fear about the COVID-19 has prompted a reduction in economic activity worldwide, particularly the production and supply chain of goods and services (Boot et al., 2020). In addition, the COVID-19 pandemic adversely affects the world economy by reducing tourism, trade, and locally increasing food shortages (Tiberiu, 2020). The outbreak of COVID-19 forced major banks and institutions in many countries to cut their growth forecasts by shutdown offices, factories, air transports, restaurants, and retail stores, which adversely affect the real economy, as it combines supply, demand, and uncertainty shocks (Selmi & Bouoiyour, 2020). Nikiforos (2020) documented that the spread of COVID-19 is a major shock for the global economies that has also led to a severe drop in the stock market. Due to the global spread of COVID-19, financial markets around the globe reacted pessimistically and behave in such a way that was not seen since the 2008 credit crunch (Colvin & McLaughlin, 2020). Coleman (2020) and Nikiforos (2020) reported that on March 12th and 16th, 2020, the US S&P-500 index dropped to its highest level in 1 day in the market history, while on February 3, 2020, the Shanghai stock market fell by 8% (Tiberiu, 2020). Many analysts and researchers have linked the dropped in global financial markets with the ongoing COVID-19 pandemic (Nikiforos, 2020; Selmi & Bouoiyour, 2020; Zhang et al., 2020) that leads to volatile and negative aggregate market reactions (Ramelli & Wagner, 2020). The continued impact of anxiety on financial markets and global growth depends on the spread and duration of the outbreak of COVID-19, governments, and major central bank policy responses. This impact on financial markets will become severe if no proper remedy is found quickly (Selmi & Bouoiyour, 2020).

The increasing propagation of pandemic COVID-19 forced policymakers, researchers, and academicians to urgently rethink the possible impacts on global financial markets. In this line, the study contributes to the extant literature in four ways. Firstly, this study intended to give a first-hand description of the ongoing pandemic by investigating the growing impact of COVID-19 on global financial markets based on longer time series. The impact of the COVID-19 pandemic on the financial market is very recent and has short time series (Ciner, 2020; Czech et al., 2020; Haroon & Rizvi, 2020; Mirza et al., 2020; Sansa, 2020; Tiberiu, 2020; Zhang et al., 2020). Just and Echaust (2020) and Tahat and Ahmed (2020) recommended that future studies should consider longer time series to get more robust results.

Secondly, to the best of available literature, the study considers for the first time both the developed and emerging countries' markets based on the high confirmed cases. The outbreak of the COVID-19 pandemic initially hit the developed economies including the UK, USA, Spain, Germany, and Italy, and its second wave unfolding the emerging market economies (Rakshit & Neog, 2021). Hevia and Neumeyer (2020) documented that the COVID-19 pandemic arises as to the largest macroeconomic shocks that affect both the developed and emerging markets. Contemporary researchers consider either a single market (Ciner, 2020; Mirza et al., 2020; Tiberiu, 2020) or emerging markets (Czech et al., 2020), but do not consider both developed and emerging markets. In this line, Machmuddah et al. (2020) suggested that research based on comparative studies is needed by taking more global samples.

Thirdly, to be in line with the most recent studies on the impact of COVID-19 pandemic on market returns (Al-Awadhi et al., 2020; Anh & Gan, 2020; Ashraf, 2020; Zhang et al., 2020), the study investigated the impact of WHO official announcement regarding the propagation of COVID-19 pandemic, deaths reported, new COVID-19 tests conducted, positive growth rate of COVID-19 virus, poverty index, life expectancy index, and development index on market return in developed and emerging markets. Considering a large set of variables reduces the problem of omitted variable bias and brings more accuracy in explaining the changes in stock market returns (Rakshit & Neog, 2021).

Finally, from a methodological view, this study adopts the most suitable and robust methods like panel estimated generalized least square (panel-EGLS) and quantile regression approach to estimate the effect of the COVID-19 pandemic on the global financial markets. Contemporary researchers on the relationship between COVID-19 pandemic and market returns either used static panel models (Al-Awadhi et al., 2020; Anh & Gan, 2020; Ashraf, 2020; Tahat & Ahmed, 2020) or classical event-study methods (He et al., 2020; Liu et al., 2020a, b; Machmuddah et al., 2020). Ciner (2020) suggested that estimating financial market returns during the COVID-19 pandemic through modern penalized regressions could provide robust results. Moreover, for broader application, longitudinal studies are required to accumulate the results of financial markets during the COVID-19 pandemic (Machmuddah et al., 2020).

In this context, the current study aims to investigate the impact of the COVID-19 pandemic on the global financial markets of the most affected countries and compare the results of two subsamples, developed and emerging markets. To the best of our knowledge, this study is novel and the first to investigate the global financial market returns during the COVID-19 pandemic in both developed and emerging markets.

With this, the study confirms that the new confirmed COVID-19 daily cases, news announcements of confirmed COVID-19 daily deaths, and the positive rate of new COVID-19 cases have negatively affected market returns. In a nutshell, the COVID-19 pandemic has unsurprisingly negatively affected the global markets. Likewise, the study also found similar effects for both developed and emerging markets except the news announcement of new COVID-19 daily deaths, which have a positive effect on emerging markets' returns.

The rest of the paper is as follows: "Literature Review" section provides theoretical and empirical literature about Pandemics. "Data and Methodology" section

provides the research design. “[Empirical Results](#)” section reported the empirical results and “[Conclusion and Policy Implications](#)” section concludes the paper.

Literature Review

The speedy propagation of the outbreak of the COVID-19 and declaration as a pandemic by the World Health Organization (WHO) has led to the fear and an interest in other historical pandemics. In the past 300 years, Potter (2001) reported about 10 pandemics and argued that due to the repeated non-regular periodic pattern, I cannot ignore the possibility of new medical disasters in the future. Among those, the pandemics of the Black Death or bubonic plague in the fourteenth century and the 1918 influenza, known as the Spanish flu in 1918–1919, were the more severe, killing approximately 30 to 60 million people (Jonung & Roeger, 2006). Besides, in the twentieth century, three pandemics arose, namely, the Spanish flu (1918), the Asian flu (1957), and the Hong Kong flu (1968) (Kilbourne, 2006). Moreover, the more recent pandemics were severe acute respiratory syndrome (SARS) in 2003, swine flu in 2009, Middle East respiratory syndrome (MERS) in 2012, and Ebola in 2014.

Prior studies on the microeconomic impact of past pandemics and other diseases are mixed and provide inconclusive results (Bell & Lewis, 2005; Jonung & Roeger, 2006). For instance, Brainerd and Siegler (2003) found a positive effect of Spanish flu on economic growth. Similarly, Young (2005) documented the positive effect of the AIDS epidemic on net future per capita consumption while Bell et al. (2004) found the negative results. Ismahene (2021) examined the effect of infectious diseases on trade and economic growth in 88 developed and developing countries and found that infectious disease negatively influence economic growth and trade openness. Additionally, studies also found insignificant results of the pandemic on the stock markets, because no one knows by how much and how long the stock prices will fall (Jonung & Roeger, 2006).

Many analysts and researchers are calling the COVID-19 pandemic a Black Swan event (Lloyd, 2020), which is very close to the 1918 Spanish flu pandemic (Colvin & McLaughlin, 2020). Despite the similarities between COVID-19 and the 1918 Spanish flu pandemic, there are also some differences between these two pandemics (Lloyd, 2020). The global mortality rate of COVID-19 is 4.84%, while initially, WHO estimated a 2% mortality rate and then increase it to 3.4% by March 3, 2020.¹ The global mortality rate of COVID-19 is greater than the mortality rate of swine flu (0.02%) and Spanish flu (0.95%),² but less than the mortality rate of SARS (9.6%) and MERS (34.4%).³

¹ On March 3, 2020, WHO Director-General Dr. Tedros Adhanom Ghebreyesus in media briefing on COVID-19 stated: “Globally, about 3.4% of reported COVID-19 cases have died.”

² Spreeuwenberg et al. (2018). Reassessing the global mortality burden of the 1918 influenza pandemic, *American Journal of Epidemiology*, 187 (12): 2561–2567. <https://doi.org/10.1093/aje/kwy191>. PMID 30,202,996.

³ Source: Johns Hopkins, CDC, World Health Organization, New England Journal of Medicine.

The severity and mortality rate of the COVID-19 pandemic pose a great challenge for policymakers, investors, and individuals at large. The health risks of epidemics and disease outbreaks creating panic and fear lead to various risks to the economy (Ismahene, 2021). The novelty of the new virus COVID-19 generates fearsome and additional stress on the financial markets around the globe. The new COVID-19 pandemic creates shock waves on financial markets, which resultantly increase price volatility (Albulescu, 2020). In addition, Ramelli and Wagner (2020) argued that the future economic effect of the COVID-19 pandemic is highly uncertain, as the virus epidemic creates the risk of a financial pandemic (Boot et al., 2020). Hartwell (2018) reported that different sources like institutional issues, economic conditions, or market uncertainty affect the financial markets. Following this, Onan et al. (2014) and Tiberiu (2020) argued that bad and good macroeconomic announcements also affect financial markets. Some recent prior studies related the economic policy uncertainty (EPU) with financial markets (Kalyvas et al., 2020; Li & Zhong, 2020; Mei et al., 2018; Tiwari et al., 2019). To maintain liquidity in the markets, different governments apply strategies of the optimized supply chain, cutting interest rates, increasing the purchase of government bonds, and many others (Boot et al., 2020; Lloyd, 2020).

Despite the heterogeneous responses of different financial markets against the COVID-19 pandemic, to this point, neither of the financial markets around the globe responded strongly to the outbreak of COVID-19. Selmi and Bouoiyour (2020) documented that the impact of the COVID-19 pandemic could be much harmful to investors and the global economy. COVID-19 pandemic crisis leads to market inefficiency and income inequality (Hong et al., 2021).

Hypothesis Development

Recognizing the possible economic impact of the COVID-19 pandemic on financial market returns, when the COVID-19 pandemic happened, has emerged very sharply in recent years. Recent academic researches around the globe made several attempts to examine the impact of the COVID-19 pandemic on the financial stock market in different countries and found an adverse relationship between the COVID-19 pandemic and market returns (Alfaro et al., 2020; He et al., 2020; Liu et al., 2020a, b; Narayan et al., 2020; Zhang et al., 2020). Other studies conducted by Al-Awadhi et al. (2020) and Anh and Gan (2020) have reported a negative effect of the COVID-19 pandemic on financial market returns. Consistently, Ashraf (2020) reported that the COVID-19 pandemic has a significantly negative effect on market returns. Hung et al. (2021) analyzed the impact of the COVID-19 pandemic on the Vietnamese stock market and found a significantly negative effect of the COVID-19 pandemic on market returns. Harjoto et al. (2021) showed that the COVID-19 pandemic adversely impacts the financial markets of emerging economies more than developed economies. Similarly, Alexakis et al. (2021) and Basuony et al. (2021) also found an adverse effect of COVID-19 pandemic on stock market returns.

Due to consistency in empirical outcomes of recent studies, hypotheses are constructed based on the expected sign of the relationship of COVID-19 pandemic with stock market returns in Table 1.

Data and Methodology

Data and Variables

The main objective of the study is to estimate how global financial markets react to the growing impact of the COVID-19 pandemic. To accomplish this, a sample of 30 most affected developed and developing countries were used, which consists of 5810 daily observations of COVID-19-related variables and market closing prices. A panel data that range from January 1, 2020, to December 12, 2020, were collected from different secondary sources. The COVID-19 and control variables data were collected from the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University and Global Change Data Labs (GCDL). For market returns, the daily closing prices of each sampled countries' market indexes were collected from the global financial website (www.investing.com). A detailed description and source of dependent, independent, and control variables are presented in Table 2.

Analytical Methods

To empirically examine the effect of the COVID-19 pandemic on the global financial markets in panel data framework, the study followed the methodology of Aldieri and Vinci (2017), Baker (2016), Cepoi (2020), and Kuan et al. (2012) and used panel estimated generalized least square (panel-EGLS) and panel quantile regression approach. These methods have several advantages over the other methods used in prior studies.

First, panel data models can have autocorrelation and heteroscedasticity between errors both contemporaneously and over time. In such a situation, it is recommended to use the panel-EGLS method (Mance et al., 2020). Second, from the panel data framework, the contemporary researches on COVID-19 pandemic and financial markets relationship used either pooled ordinary least square (Albulescu, 2020; Ashraf, 2020; Raifu et al., 2021), fixed effect (Al-Awadhi et al., 2020; Anh & Gan, 2020), or random effect (Anh & Gan, 2020). However, these methods only use the central tendency of the data and ignore the view that for a different level of market returns, the effect of the independent variable will be different (Kuan et al., 2012). Therefore, quantile regression is a non-linear data model (Galvao et al., 2020) and is more successful in finance and economics due to the ability to draw inferences about the data that rank above or below the population conditional mean (Cepoi, 2020). Third, regarding the link between variables, especially for extreme events, the quantile-varying estimates show that ordinary least square methods provide an incomplete picture. While throughout the asset return distributions, quantile regression is more suitable in handling the extreme values and fat tails problems (Du

Table 1 Hypotheses with expected signs and source

Variables	Hypothesis	Expected sign	Source of prior studies
New cases	H1	Negative (–)	(Al-Awadhi et al., 2020; Anh & Gan, 2020; Ashraf, 2020; Hong et al., 2021)
New deaths	H2	Negative (–)	(Al-Awadhi et al., 2020; Basuony et al., 2021; Raifu et al., 2021)
Reproduction rate	H3	Negative (–)	(Burdekin & Harrison, 2021; Díaz et al., 2022)
New tests	H4	Positive (+)	(Anser et al., 2021)
Positive rate	H5	Negative (–)	(Chajuthamard et al., 2021; Xu, 2021)
Stringency index	H6	Negative (–)	(Alexakis et al., 2021; Burdekin & Harrison, 2021; Raifu et al., 2021)
Extreme poverty index	H7	Negative (–)	(Umar & Nayan, 2018)
Life expectancy index	H8	Positive (+)	(Umar & Nayan, 2018)
Human development index	H9	Positive (+)	(Forti et al., 2011; Ranis et al., 2000)

Table 2 Variable description and source

Variables	Symbol	Description	Data source
Financial market returns	MR	Logarithmic change between today and yesterday's closing price	investing.com
New cases	NC	Natural logarithm of the new confirmed COVID-19 infected cases in a given day	CSSE
New deaths	ND	The natural logarithm of the new confirms death due to COVID-19 in a given day	CSSE
Reproduction rate	RR	Percentage of the real-time estimate of the effective reproduction of COVID-19	GCDL
New tests	NT	Natural logarithm of total new tests of COVID-19 conducted in a given day	GCDL
Positive rate	PR	Percentage of COVID-19 positive test based on rolling 7-day average	GCDL
Stringency index	STindex	Government response to COVID-19, the closure of schools and workplaces, travel banes, etc., and rescaled from 0 to 100	GCDL
Extreme poverty index	EPindex	Percentage of population living in extreme poverty	GCDL
Life expectancy index	LEindex	Average life at birth in the year 2019	GCDL
Human development index	HDindex	Average of achieved key dimensions of human development such as being knowledgeable, long and healthy life, and good living standards	GCDL

CSSE stands for Center for Systems Science and Engineering at Johns Hopkins University, GCDL stands for Global Change Data Labs

Plooy, 2019). Similarly, Barnes and Hughes (2002) argued that quantile regression also mitigates the problem of non-Gaussian error distribution and sensitivity to outliers. Moreover, most of the developed markets show asymmetric dependencies in COVID-19-related information (Cepoi, 2020). Hence, quantile regression provides a more complete picture of any structure while accounting for asymmetries and non-linearities (Azimli, 2020). Finally, a quantile regression also corrects endogenous repressors' biases in panel data (Aldieri & Vinci, 2017).

Analysis Procedure

Following Ciner (2020), the panel data equations are used to achieve the required objectives as follows.

$$Y_{it} = \alpha + \beta_1 Y_{it-1} + \beta_2 COVID - 19_{it-1} + \varepsilon_{it} \quad (1)$$

$$Y_{it} = \alpha + \beta_1 Y_{it-1} + \beta_2 COVID - 19_{it-1} + \sum_{j=1}^n \delta_j control_{jit} + \varepsilon_{it} \quad (2)$$

where Y_{it} is the dependent variable that consists of the stock market returns. These market returns were calculated by taking the logarithmic change of the current closing index price and the previous day's closing price (Anh & Gan, 2020; Ciner, 2020; Haroon & Rizvi, 2020).

Just like Tiberiu (2020), I applied a stepwise procedure for the effect of the COVID-19 pandemic on the global financial markets. In the first step, I implemented a naïve estimation for Eq. (1) at EGLS and quantile regression for 25th, 50th, and 75th quantiles. While in the second step, I included all the control variables in Eq. (2) and estimate them through the EGLS and quantile regression for the same quantiles.

Moreover, to compare the effect of the COVID-19 pandemic on the global financial markets in developed and developing markets, I divided the whole sample into two subsamples based on the markets (i.e., developed and emerging) and re-estimated the Eqs. (1) and (2) for each market separately.

Empirical Results

Mean Statistic

Table 3 reports country-wise mean results of the dependent, independent, and control variables. During the study period, the mean return and market volatility for all the markets were positive and negative, respectively. The mean number of COVID-19 new cases and new deaths in all the selected countries were 5544 and 126, respectively. The average number of COVID-19 tests was 89,970 of which 9% were reported positive.

Table 3 Country-wise mean values of all the study variables

Country	MR	NC	ND	NT	PR	RR	STindex	HDindex	LEindex	EPindex
Argentina	0.000	4579.19	124.64	11,945.68	0.29	1.19	72.58	0.83	76.69	0.60
Australia	-0.010	87.21	2.83	38,617.53	0.00	1.03	54.74	0.94	83.43	0.50
Austria	-0.004	959.72	12.47	11,391.80	0.06	1.19	45.92	0.91	81.49	0.78
Bangladesh	-0.003	1501.39	21.51	10,367.20	0.15	1.16	66.66	0.61	72.59	14.80
Belgium	0.004	1852.25	54.54	21,784.24	0.08	1.18	51.74	0.92	81.63	0.20
Brazil	0.019	20,794.39	555.01	–	–	1.23	57.95	0.76	75.88	3.40
Canada	-0.009	1348.11	40.15	44,968.24	0.04	1.19	53.87	0.93	82.43	0.50
Chile	-0.006	1755.56	48.85	21,608.80	0.12	1.15	63.11	0.84	80.18	1.30
China	-0.002	290.45	14.73	–	–	1.06	69.94	0.75	76.91	0.70
Colombia	-0.004	4313.43	118.87	19,117.03	0.02	1.19	65.19	0.75	77.29	4.50
Denmark	0.000	296.98	2.81	26,093.25	–	1.13	45.70	0.93	80.90	0.20
France	0.007	7361.98	175.87	139,944.90	0.05	1.30	55.27	0.90	82.66	–
Germany	0.004	3829.50	62.31	–	0.03	1.22	51.35	0.94	81.33	–
India	0.008	30,329.75	440.37	585,923.70	0.07	1.24	64.28	0.64	69.66	21.20
Indonesia	-0.011	1828.17	56.07	15,877.88	0.14	1.16	54.66	0.69	71.72	5.70
Japan	0.008	518.97	7.27	11,358.32	0.06	1.14	33.44	0.91	84.63	–
Mexico	-0.001	3717.31	345.40	7302.27	0.32	1.18	56.47	0.77	75.05	2.50
Morocco	-0.007	1196.54	19.84	14,377.19	0.10	1.18	59.96	0.67	76.68	1.00
Netherlands	-0.015	1806.84	30.71	–	0.08	1.17	48.35	0.93	82.28	–
New Zealand	0.013	6.50	0.08	4646.04	0.00	0.85	37.27	0.92	82.29	–
Pakistan	0.008	1337.67	26.83	21,772.99	0.09	1.16	54.86	0.56	67.27	4.00

Table 3 (continued)

Country	MR	NC	ND	NT	PR	RR	STindex	HDindex	LEindex	EPindex
Peru	-0.001	3033.99	113.00	4689.90	–	1.18	68.40	0.75	76.74	3.50
Philippines	-0.003	1379.39	27.01	22,876.94	0.07	1.15	67.68	0.70	71.23	–
Russia	-0.004	7765.46	136.06	291,637.00	0.03	1.22	52.55	0.82	72.58	0.10
South Africa	0.015	2560.40	69.88	20,797.15	0.10	1.16	55.16	0.70	64.13	18.90
Spain	-0.009	5303.20	145.31	–	0.07	1.25	56.31	0.89	83.56	1.00
Switzerland	0.001	1117.03	17.42	9207.81	0.07	1.22	42.13	0.94	83.78	–
Turkey	-0.011	2783.89	47.71	78,014.30	0.04	1.21	53.93	0.79	77.69	0.20
UK	0.008	5467.01	193.55	156,396.80	0.05	1.20	56.75	0.92	81.32	0.20
USA	0.003	47,243.48	891.74	713,956.80	0.09	1.28	56.50	0.92	78.97	1.15
All	0.000	5544.65	126.74	89,970.36	0.09	1.17	55.76	0.82	77.76	3.79

Table 4 Panel unit root (at level) and variance inflation (VIF) tests

Variables	Panel unit root test				VIF
	Levin, Lin, and Chu	Im, Pesaran, and Shin W-stat	ADF—Fisher chi-square	PP—Fisher chi-square	
MR	−34.84***	−44.34***	1788.43***	4245.62***	—
LnNC	−1.94**	−4.20***	118.08***	545.96***	3.93
LnND	−2.51***	−3.02***	97.26***	610.09***	5.75
LnNT	−3.23***	−2.72***	69.37**	220.73***	1.32
LnPR	−3.41***	−4.98***	126.35***	172.13***	1.90
LnRR	−18.33***	−15.97***	451.06***	364.29***	1.28
STindex	−7.28***	−4.66***	104.75***	91.99***	1.45
HDindex	−5.07***	−5.92***	45.23***	33.37***	6.07
LEindex	−5.07***	−5.92***	45.23***	33.37***	4.70
EPindex	−3.58***	−4.49***	24.90***	18.42***	3.16

** and *** denote significance at 1% and 5%, respectively. Other tests of the unit root cannot be performed on variables LnP and LnGDP due to the strongly balance problem

Unit Root and Multicollinearity Problem

For the unit root problem in this study, I used Im et al. (2003), Levin et al. (2002), and ADF and PP Fisher chi-square tests proposed by Maddala and Wu (1999). The results of the four stationarity tests reported in Table 4 reject the null hypothesis of non-stationarity for all the variables. Therefore, it is concluded that all the variables used in this study are stationary at level. Moreover, Table 4 also reports the results of the variance inflation factor (VIF) test. According to Belsley et al. (2005), the VIF less than 10 indicates no multicollinearity problem. Therefore, based on the VIF results, I concluded that there is no multicollinearity issue in the data.

COVID-19 and Global Market Returns

Table 5 indicates the results of Eqs. (1) and (2) for the entire sample based on panel-EGLS and panel quantile regression for 25th, 50th, and 75th quantiles. The panel-EGLS results show a significantly negative relation of COVID-19 new cases with market returns for both the naïve and control models, which confirms H1.

However, COVID-19 new daily death cases, reproduction rate (RR), and positive rate (PR) have no impact on market returns. Moreover, the number of new COVID-19 daily tests conducted has a significantly positive impact on market returns confirming H4.

From quantile regression results, in the naïve model, the coefficient of NC is significantly negative at lower and median quantiles (i.e., 25th and 50th quantiles) with market returns, confirming H1. ND is significantly negative with market returns at lower and median quantiles (H2 confirmed), while positively significant at upper quantile (i.e., 75th quantile), which rejects H2. Further, NT is negatively significant with market returns at all the quantiles, rejecting H4. Moreover, PR and RR are

Table 5 Results of the effect of COVID-19 on financial market returns

Depended variable: market returns								
Variables	Panel-EGLS		Panel quantile regressions					
	Naive model		Naive model		Control			
	25th	50th	25th	50th	75th	25th	50th	75th
Constant	0.000 (1.94)*	-0.012 (-1.60)	-0.000 (-2.80)***	-0.000 (-2.34)**	0.001 (1.25)	-0.002 (-0.67)	0.000 (4.04)***	-0.040 (-2.29)**
MR($t-1$)	-0.016 (-1.17)	-0.002 (-0.12)	-0.009 (-2.38)***	-0.000 (8.68)***	-0.003 (-0.189)	-0.008 (-1.66)*	0.000 (3.92)***	-0.017 (-1.37)
LnNC($t-1$)	-0.000 (-2.63)***	-0.000 (-2.00)**	-0.000 (-2.54)***	-0.000 (-7.96)***	-0.000 (-1.42)	-0.000 (-1.87)*	-0.000 (-7.72)***	-0.000 (-1.18)
LnND($t-1$)	0.000 (1.17)	0.000 (0.622)	-0.000 (2.78)***	-0.000 (-11.93)***	0.000 (2.03)**	0.000 (1.49)	-0.000 (-5.50)***	0.000 (2.12)**
LnNT($t-1$)	0.000 (4.01)***	0.000 (1.97)**	0.000 (-3.25)***	0.000 (4.23)***	0.000 (2.49)**	0.000 (0.70)	0.000 (9.79)***	0.000 (2.25)**
LnPR($t-1$)	-0.001 (-1.07)	-0.001 (-0.97)	0.000 (1.98)**	0.000 (6.80)***	-0.002 (-0.89)	0.000 (0.98)	0.000 (19.39)***	-0.000 (-0.15)
LnRR($t-1$)	0.000 (0.93)	-0.000 (-0.10)	0.000 (1.98)**	0.000 (-6.64)***	0.000 (0.09)	0.000 (-1.65)*	0.000 (6.41)***	0.000 (0.495)
STindex		0.000 (1.74)*				0.000 (2.77)***	-0.000 (-13.38)***	0.000 (2.30)**
HDindex		-0.016 (-2.18)**				0.003 (1.38)	0.000 (5.01)***	-0.043 (-2.91)***
LEindex		0.000 (1.04)				-0.000 (-0.19)	-0.000 (-8.74)***	0.000 (1.79)*
EPindex		0.000 (1.14)				-0.000 (-1.52)	-0.000 (-3.22)***	0.000 (1.98)**
No. of obs	5810	4513	5810	5810	5810	4513	4513	4513
Country effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic	2.32***	1.92**						
Quasi-LR statistic			30.61***	93.5***	31.64***	76.32***	36.9***	34.17***

*, **, and *** denote significance at 1%, 5%, and 10%, respectively. *t*-statistics are reported in parenthesis

significantly positive with market returns at lower and median quantiles only, rejecting H3 and H5. The negative relation of NC and ND due to COVID-19 with market returns confirms H1 and H2, respectively. Further, the result of the positive impact of NT on market returns confirms H4. From the control model in quantile regression, the study found almost similar results for the impact of COVID-19 on market returns.

COVID-19 and Market Returns: Developed and Emerging Markets

Table 6 reports the results of Eqs. (1) and (2) for the subsamples of developed and emerging markets. Panel A reported the results of developed markets. In the column of panel-EGLS, the coefficients of ND and NT both in naïve and control models are insignificant with the market returns. While the impact of NC on market returns is significantly negative only in the naïve model, confirming H1. Moreover, the positive rate of COVID-19 infection has a significantly negative influence on market returns in both naïve and control models. This result confirms H5. The results of quantile regression for panel A reveal negative relation of NC with market returns for all the three quantiles in the naïve model and the lower and upper quantiles (i.e., 25th and 75th) in the control model. The results of ND are significantly negative at the median and upper quantile in the naïve model and an upper quantile in the control model, which confirms hypothesis H2. Furthermore, the coefficients of new COVID-19 tests conducted have a significantly positive impact on market returns at all the quantiles in the naïve model and upper and lower quantiles in the control model. Similarly, the negative relation of NC and PR of COVID-19 with market returns confirms H1 and H5. Further, the result of the positive impact of NT on market returns confirms H4.

Panel B of Table 6 reported the results for emerging markets. Likewise developed markets, I found similar results for NC, NT, PR, and RR with market returns. Contrary to developed markets, the coefficients of news announcements of new COVID-19 deaths have a positive impact on emerging markets' returns.

Discussions

In Table 5, from the results of panel-EGLS, an adverse impact of COVID-19 new daily cases on market returns is in line with existing studies that predict the negative impact of new cases of COVID-19 on market returns (Al-Awadhi et al., 2020; Anh & Gan, 2020; Ashraf, 2020; Hong et al., 2021). Similarly, the positive influence of the new daily COVID-19 test conducted on market returns is consistent with the OECD (2020) conclusion that the increasing of COVID-19 daily testing capacity can revitalize the economy and strengthen the health workforce. Likewise, the increasing number of the COVID-19 test will help to reduce new COVID-19 cases (Cirakli et al., 2021). This leads to reducing the instability in investors' reaction to the COVID-19 pandemic and resultantly causes upward movements in the market. This result is also in line with the findings of Anser et al. (2021).

From the quantile regression, the positive results of NC, PR, and RR of COVID-19 are in line with the findings of Waheed et al. (2020), who reported a positive increase in the market index due to the COVID-19 pandemic. Similarly, the negative impact of new deaths due to COVID-19 on market returns is in line with Just and Echaust (2020), who also found negative relation of new COVID-19 confirmed deaths with the market returns. Further, the result of the positive impact of NT on market returns confirms the findings of OECD (2020).

Table 6 reports the results of Eqs. (1) and (2) for developed and emerging markets. In panel A of developed markets, the negative relation of NC with market returns in the naïve model confirms the previous findings of Al-Awadhi et al. (2020), Anh and Gan (2020), and Ashraf (2020). Moreover, the negative relation of PR with market returns in both naïve and control models is consistent with the findings of existing studies (Chatjuthamard et al., 2021; Xu, 2021). The results of the negative impact of ND on market returns are in line with the results of Just and Echaust (2020), who documented that the announcement news about new COVID-19 deaths are highly correlated in developed countries and indicates a simultaneous course of events. Similarly, the negative relation of new COVID-19 cases with market returns is supported by the results of Al-Awadhi et al. (2020) and Anh and Gan (2020). Further, the result of the positive impact of NT on market returns confirms the findings of OECD (2020). The negative impact of the positive rate of COVID-19 infection on market returns is supported by the views of Liu et al. (2020, b), who argued that the COVID-19 pandemic increases the fear of the investors and creates pessimistic sentiments on future returns. Similarly, this result is also consistent with the findings of Tahat and Ahmed (2020).

Panel B of Table 6 reported the results for emerging markets. Likewise developed markets, similar results were found for NC, NT, PR, and RR with market returns except for the news announcement of new COVID-19 deaths which has a positive impact on emerging markets' returns. This result is supported by the findings of Hua (2020), who documented for China that contrary to other financial markets, in response to the spread of COVID-19 at a devastating rate, China's financial market remained more stable. Similarly, for an emerging market, Waheed et al. (2020) reported a positive increase in the Pakistani market index due to the COVID-19 pandemic.

For robustness purposes, almost all relevant estimates in the naïve and control models retain their signs and statistical significance under both the specification of panel-EGLS and quantile regression illustrating in this way their robustness.

Conclusion and Policy Implications

The main purpose of the study is to examine the influence of the COVID-19 pandemic on the daily market returns of the 30 most affected developed and emerging economies from January 1, 2020, to December 12, 2020. For this purpose, in the panel data framework, the study employed panel-EGLS and panel quantile regressions techniques. The study confirms that the new confirmed COVID-19 daily cases significantly negative impact on market returns. Similarly, the news announcement

Table 6 Results of the effect of COVID-19 on financial market returns

Panel A: developed markets									
Depended variable: market returns									
Variables	Panel-EGLS			Panel quantile regressions					
	Naïve model		Control	Naïve model			Control		
	25th	50th	75th	25th	50th	75th	25th	50th	75th
Constant	0.000 (2.06)**	-0.015 (-0.18)		0.000 (0.74)	0.000 (0.89)	0.001 (2.69)***	-0.054 (-0.62)	0.000 (5.22)***	-0.007 (-0.059)
MR($t-1$)	-0.089 (-4.56)***	-0.080 (-3.318)***		-0.051 (-5.59)***	-0.000 (-9.61)***	-0.035 (-2.33)**	-0.054 (-3.77)***	-0.000 (-29.85)***	-0.079 (-5.18)***
LnNC($t-1$)	-0.000 (-2.34)**	-0.000 (-0.252)		-0.000 (-2.08)**	-0.000 (8.02)***	-0.000 (-1.90)*	-0.000 (-2.37)**	-0.000 (-0.24)	-0.000 (1.74)*
LnND($t-1$)	0.000 (0.86)	0.000 (0.753)		0.000 (1.64)	-0.000 (3.02)***	-0.000 (1.82)*	-0.000 (-0.25)	-0.000 (1.10)	-0.000 (1.71)*
LnNT($t-1$)	0.000 (1.50)	-0.000 (-0.05)		0.000 (-3.35)***	0.000 (2.29)**	0.000 (2.94)***	0.000 (-1.81)*	0.000 (0.19)	0.000 (2.24)**
LnPR($t-1$)	-0.000 (-2.50)**	-0.007 (-2.44)**		0.003 (1.53)	-0.000 (1.71)*	-0.002 (-0.57)	0.002 (0.60)	0.000 (1.24)	-0.001 (-0.25)
LnRR($t-1$)	0.000 (0.84)	0.001 (2.23)**		-0.001 (-1.47)	-0.000 (-0.77)	-0.000 (-1.16)	-0.000 (-0.46)	0.000 (2.28)**	0.001 (0.94)
STindex		0.000 (1.93)*					0.000 (3.27)***	0.000 (1.40)	0.000 (2.71)***
HDindex		-0.006 (-0.07)					-0.064 (-1.00)	0.000 (3.97)***	0.042 (0.510)
LEindex		0.000 (0.13)					-0.000 (-0.78)	-0.000 (-3.97)***	0.001 (0.76)
EPindex		0.000 (0.14)					-0.004 (-1.34)	0.000 (2.22)**	0.003 (1.07)
No. of obs	2850	1785		2850	2850	2850	1785	1785	1785
Country effect	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
F-statistic	4.38***	2.65**							
Quasi-LR stat				55.79***	70.12***	42.51***	87.87***	85.5***	102.64***

Table 6 (continued)

Panel B: emerging markets										
Depended variable: market returns										
Panel-EGLS		Panel quantile regressions								
Naive model	Control	Naive model			Control			50th	75th	75th
		25th	50th	75th	25th	50th	75th			
0.000 (0.07)	-0.012 (-1.11)	0.001 (0.76)	0.001 (0.73)	0.001 (0.44)	-0.003 (-1.64)*	0.000 (10.56)***	-0.02 (-1.15)			
0.025 (1.39)	0.032 (1.69)*	0.048 (2.54)**	0.048 (2.61)***	0.048 (1.87)*	0.000 (0.28)	0.000 (8.71)***	0.04 (1.52)			
-0.000 (-2.18)**	-0.000 (-1.96)**	-0.001 (-3.24)***	-0.001 (-3.73)***	-0.001 (-2.15)**	0.000 (0.37)	-0.000 (2.11)**	-0.001 (-1.84)*			
0.000 (1.82)*	0.000 (1.12)	0.001 (3.41)***	0.001 (3.60)***	0.001 (3.64)***	-0.000 (-0.57)	0.000 (2.68)**	0.001 (2.20)**			
0.000 (2.79)***	0.000 (2.99)***	0.000 (1.71)*	0.000 (1.49)	0.000 (5.49)***	0.000 (0.20)	0.000 (5.91)***	0.000 (3.98)***			
-0.001 (-0.74)	-0.001 (-0.32)	-0.003 (-1.65)*	-0.003 (-1.40)	-0.003 (-1.52)	0.000 (0.15)	-0.000 (1.82)*	-0.002 (-0.47)			
0.000 (0.82)	0.000 (0.14)	0.002 (2.29)**	0.002 (2.70)***	0.002 (1.17)	0.000 (0.13)	0.000 (5.28)***	0.001 (0.54)			
	0.000 (1.93)*				0.000 (1.31)	-0.000 (-4.32)***	0.000 (1.57)			
	-0.009 (-1.04)				0.002 (1.43)	0.000 (6.35)***	-0.011 (-0.68)			
	-0.000 (-0.31)				0.000 (1.52)	-0.000 (-5.08)***	0.000 (0.14)			
2960	2728	2960	2960	2960	-0.000 (-2.92)***	-0.000 (-5.29)***	0.000 (0.24)			
Yes	Yes	Yes	Yes	Yes	2728	2728	2728			
2.55***	2.41***	95.04***	113.08***	23.77***	Yes	Yes	Yes			
					31.83***	131.23***	43.30***			

*, **, and *** denote significance at 1%, 5%, and 10%, respectively. *t*-statistics are reported in parenthesis

of confirmed COVID-19 daily deaths has a significantly negative relationship with market returns. Further, the positive rate of new COVID-19 cases has also negatively influenced market returns. In other words, the COVID-19 pandemic has unsurprisingly negatively affected the global markets. Besides, the number of new COVID-19 daily tests conducted has a positive impact on market returns. Likewise, the study also found similar impacts for both developed and emerging markets except the news announcement of new COVID-19 daily deaths, which have a positive impact on emerging markets' returns.

This study presents some policy implications for investors as well as for governments. First, the negative impacts of daily new COVID-19 cases and deaths on market returns suggest that government should adopt early proactive reactions and control measures to protect financial markets from the adverse decline in future pandemics. Second, the positive impact of the increasing number of COVID-19 tests conduction on market returns shows investors' confidence and trust in government reactions to the COVID-19 pandemic. Therefore, governments should increase investors' confidence by enhancing the number of the COVID-19 testing capacity that can help to control and decline the outbreak of the COVID-19 pandemic and to attract more investors in the stock markets. However, it is suggested that this increase in testing capacity may be made through well-developed algorithms rather than an unplanned rise. Third, the impacts of the COVID-19 pandemic on market returns are almost similar for both developed and emerging markets. Therefore, governments and global communities should work together to convey accurate information and implement mutually reinforcing actions in curbing the outbreak of the COVID-19 pandemic, because such actions and information will help the governments to make calm an anxious population, informed choices, and control measures. Lastly, effective public health policies may be implemented in all the countries.

As far as recent researches, this study is original, and it is the first research to examine the influence of the COVID-19 pandemic on the daily market returns of the 30 most affected developed and emerging economies. However, the study has some limitations that need to be addressed by future researchers. First, this study is limited to the top 30 most affected countries, and it is suggested that future studies may consider other demographic, geographical, economic, and social contexts, or even consider other types of larger samples and comparing their differences and similarities would provide more insightful results. Second, this study only considers market returns as dependent variables; other studies would be carried out to contemplate the possibility of using other market variables that may be influenced by the COVID-19 pandemic. Finally, the study did not consider the effect of different waves of the COVID-19 pandemic on the global markets; therefore, it is recommended that future researchers could consider the response of global financial markets in different waves of COVID-19 pandemic.

Author Contribution The author has read and approved the manuscript.

Availability of Data and Material Data used for the analysis in this study are available from on request from the author.

Declarations

Conflict of Interest The author declares no competing interests.

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